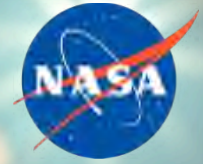


Space Commercialization



Gary Martin

Director, New Venture and Communication!
Ames Research Center!



Space commercialization is necessary to fulfill national goals and the associated policy and strategic objectives that will enable space exploration and development

“We can inspire and open the door for commercial entrepreneurial entities to become involved, to become partners with NASA.”

Charles F. Bolden, Jr.
NASA Administrator



National Policy on Commercial Space

(June 28, 2010)



A robust and competitive commercial space sector is vital to continued progress in space. **The United States is committed to encouraging and facilitating the growth of a U.S. commercial space sector that supports U.S. needs, is globally competitive, and advances U.S. leadership in the generation of new markets and innovation-driven entrepreneurship.**

Energize competitive domestic industries to participate in global markets and advance the development of: satellite manufacturing; satellite-based services; space launch; terrestrial applications; and increased entrepreneurship.

- **Purchase and use commercial space capabilities and services to the maximum practical extent**
- **Actively explore the use of inventive, nontraditional arrangements** for acquiring commercial space goods and services to meet United States Government requirements, **including measures such as public-private partnerships, ...**
- **Refrain from conducting United States Government space activities that preclude, discourage, or compete with U.S. commercial space activities ...**
- **Pursue potential opportunities for transferring routine, operational space functions** to the commercial space sector where beneficial and cost-effective.



Update!

- **"COTS – SpaceX achieved first successful test flight of Falcon 9 with Dragon capsule meeting 100% of COTS milestones at a fraction of the cost and development time of any comparable launch system.!**
- **"CCDev- Commercial Crew Development Solicitation released and proposals received. Selection planned March 2011 with funding up to \$200M.!**
- **"CRuSR awarded contracts to Armadillo and Masten for NASA test flights in 2011.!**



Update!

- **"Bigelow signed Letters of Intent with 6 nations to utilize his orbital research facilities starting 2015.!"**
- **"Google Lunar X-Prize deadline for signing up for prize Dec. 31, 2011. Twenty teams currently in competition for \$30M in prizes.!"**
- **"Innovative Lunar Demonstration Data IDIQ contracts totaling up to \$30.1M were awarded to 6 companies to provide data to NASA on commercial lunar development. These were downselected to 3 (Moon Express, Astrobotics, Rocket City Space Pioneers).!"**



Update!

- **"International Lunar Research Park unanimously endorsed at the JUSTSAP Symposium November 2010 with support from State of Hawaii and JAXA.!"**
- **"Centennial Challenges added 3 new challenges on July 13, first new challenges since 2005: !"**
 - " Nano-Satellite Launch Challenge!
 - " Night Rover Challenge!
 - " Sample Return Robot Challenge.!"



Commercialization Definition



- "**Definition:** Use of equipment sent into or through space to provide goods or services of commercial value, either by a corporation or government, in a climate conducive to expanded private sector investment and involvement in space activities
- "**Types:**
 - " Gov't or private purchase of products, goods or services
 - " Commercial end-to-end responsibility
 - " Public-private partnerships (PPPs)
 - " Cooperative or joint R&D
 - " Commercially-leveraged gov't investment (NACA model)
 - " Cooperative development (COTS)
 - " Contractual purchase (CRS)
 - " Planning and development (CCDev)



Space Commercialization Strategic Objectives



- " **Open the space frontier for a broader segment of the population, such that increasing large numbers of the American people can play, work & live in space**
- " **Achieve low-cost and reliable access to space**
- " **Enable responsive space operations**
- " **Ensure best value for the Nation and taxpayers**
- " **Continually pursue improved safety and mission success in an affordable manner.**
- " **Produce dual-use benefits for economic and national security**
- " **Sustain existing high-quality jobs and create new high-wage jobs**
- " **Stimulate and enable new commercial space markets, and orbital capabilities beyond access to orbit both in the near and long term**



Space Commercialization Strategic Objectives



- **Enable space-based infrastructure (e.g., orbital transfer services; on-orbit servicing, inspection, repair; orbital debris clean-up capabilities; lunar cargo, navigation and communications, propellant depots; and near-Earth object resource extraction)**
- **Inspire the next generation of scientists, engineers, teachers, and explorers**
- **Provide students, scientists, and researchers with new low-cost access to space capabilities**
- **Produce significant reductions or game-changing innovations in the cost, performance, safety, and/or sustainability of human exploration of space**
- **Help new markets, capabilities and services become self-sustaining**



Exploration Potential!



Human Civilization



Scientific Knowledge



Exploration Preparation



Global Partnerships



Economic Expansion

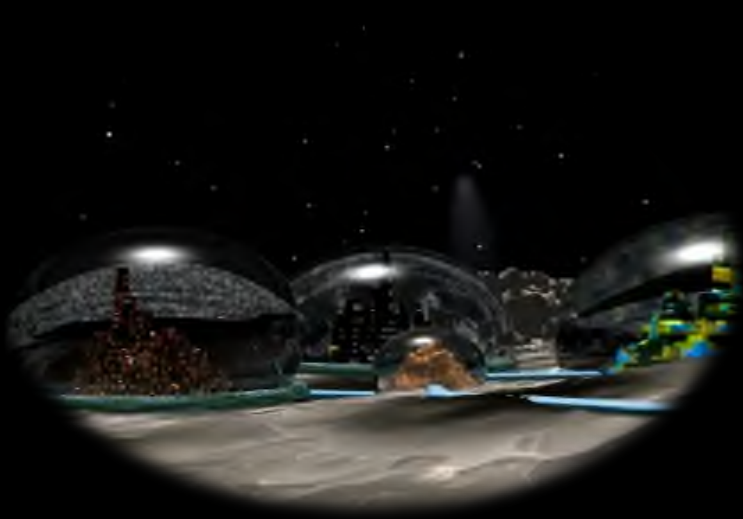


Public Engagement

Between the flags and footprints of Apollo!



Between the flags and footprints of Apollo!

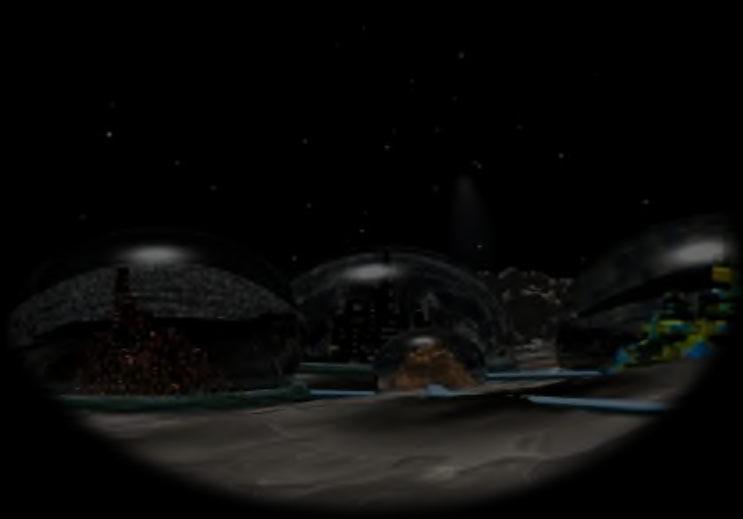


And the suburbs of Luna City!

Between the flags and footprints of Apollo!



There needs to be a !
midpoint!



And the suburbs of Luna City!

International Lunar Research Park!



where all the pieces can come together ...!

Where *we* can all come together!

and *build*

International Lunar Research Park!

Commercial Infrastructure!



Lunar University!



Science and Discovery!



Lunar Commerce!





International Lunar Research Park!



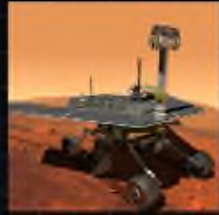
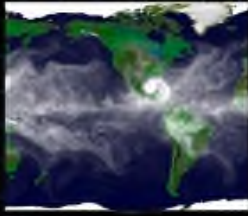
Terrestrial Analog Sites!



Lunar Robotic Village!



International Lunar Research Park!



**Provided
over 1
million
jobs in
US in
2009**

FAA Report

**2009: US
Commercial
Space up 50%
since 2006
generating
\$53B and
\$208B in 2009
when secondary and
tertiary industries are
included**

FAA Report:

2009 Space Report:

The global space economy grew 1.8 percent in 2009, rising by \$4.6 billion to \$261.6 billion in worldwide space revenues.



10 Principles to Strengthen " Commercial Space Industry!"



- 1. Create True Partnerships**
- 2. Lower Barriers to Entry**
- 3. Establish Tax and Investment Incentives**
- 4. Create Policy and Laws to Promote Space Investments**
- 5. Create a Diverse Portfolio**
- 6. Commit to Anchor Tenancy**
- 7. Invest in broadening uses of space**
- 8. Enable more minds in space**
- 9. Maximize use of commercial services**
- 10. Establish NACA Style support of commercial industry**



Private Entrepreneurship



- **" Billionaire space entrepreneurs self-funding their own space program to open space frontier for private citizens, not just short term profits or government missions.**
- **" New space entrepreneurs have demonstrated the capability to become a new force in opening space.**
- **" Competing companies have developed business plans that are not completely dependent on winning prize purses.**
- **" Space commercialization extends beyond LEO and launch vehicles to habitats, power, resource depots, robotics, IT, services, data**
- **" Tier One Venture Capitalists have made investments in space**



NACA Model



- **" Before NASA, there was the National Advisory Committee for Aeronautics (NACA)**
 - " Development of key technologies, to enabled air travel to become effective, economical and safe
 - " Study the problems of flight to identify and resolve the risks that were keeping air travel from being safe and commercially viable
 - " Government worked closely with industry to fund studies that retired technological risks and enabled private enterprise to successfully create a new industry
- **" Under this model, NASA could develop and retire the risks of new technologies to enable space transportation, private companies could incorporate the work into their own designs**



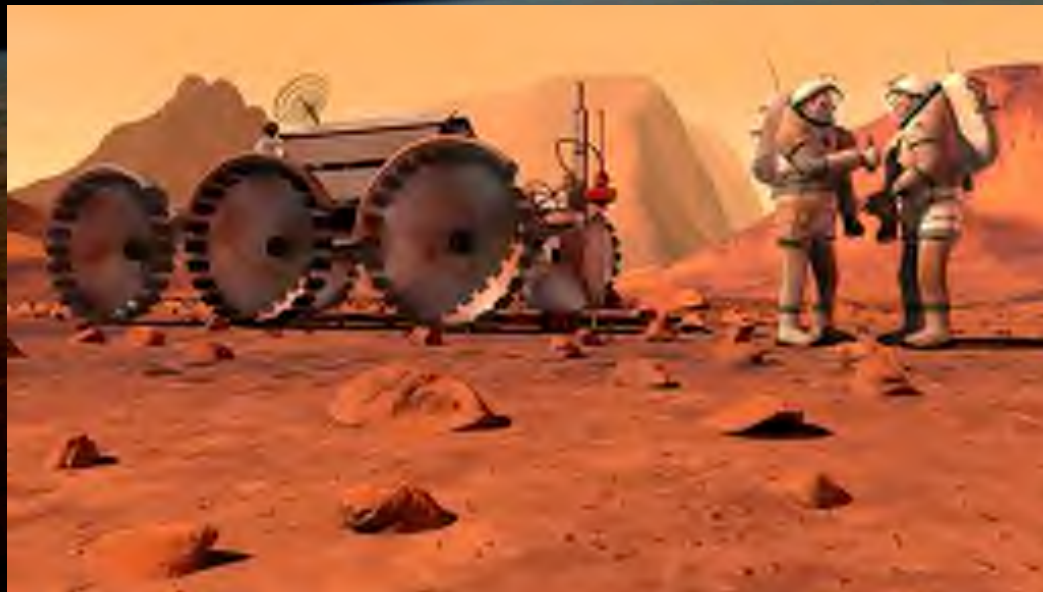


Rights to Use Space Resources



- **Outer Space Treaty - 1967**

- Precludes sovereignty over off-world territory by nations
- Principle of property rights in space is not clearly defined
- Most likely world governments would not recognize any claims of rights - serious risk that investments would be challenged under the current framework





Resources for Development



- **" Transcontinental railroad was developed and built by private industry, which was, in turn, subsidized by government property rights grants to the companies along the railroad route.**
 - " In 1862 the Congress passed the Pacific Railroad Act, which provided the railroads with 400-foot right-of-ways and ten square miles of land for every mile of track built
 - " The land was granted in checkerboard fashion, not contiguous, and was provided in lieu of cash to finance the construction of the railroad.
 - " The train companies were able to realize a return on their investment and raise construction capital by selling land to settlers.
- **" Space transportation companies that are provided property rights can recover the transportation costs of settlers or space tourists traveling to Mars or the Moon**



AUTHORITY MODEL!



- " The Antarctic Treaty System regulates international relations with respect to Antarctica, Earth's only continent without a native human population. The 1961 treaty is signed by 47 countries, sets aside Antarctica as a scientific preserve, establishes freedom of scientific investigation and bans military activity on that continent. The Antarctic Treaty Secretariat headquarters have been located in Buenos Aires, Argentina, since September 2004.!
- " 1921 – Congress establishes New York Port Authority between New York and New Jersey through an interstate compact. !
- " Most authorities are developed to be financially self-supporting within a set number of years. !
 - " In addition to owning land, setting fees, managing buildings and infrastructure, and sometimes levying taxes and charging fees, public authorities can also operate shipping terminals, airports, railroads, and irrigation facilities.!



Rights to Utilize Resources



- **Mining of the ocean bottom in international waters for hard minerals**
 - Deep Seabed Hard Mineral Resource Act 1980
 - U.S. issues its own licenses and permits and *'ensures protection of the marine environment, safety of life and property at sea, prevention of unreasonable interference with other uses of the high sea and conservation of mineral resources'*

- Establish international regime to manage licensing or permit system to protect the rights of individuals and companies in space
- Provide stronger protection for investors, recognition from many countries to the regime's right to oversee the use of space resources.

Conclusion

- " There will be sustainable settlements in space !
- " U.S. Space Exploration Policy provides context for the role that government will play in taking those first steps off Earth!
- " Space development must be done by private industry !

